

EFFECT OF JOINT OPENING ON P-WAVE VELOCITY MEASUREMENT IN ANDESITE ROCK SAMPLES

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ABSTRACT

P-wave velocity measurement can be used to evaluate the rock mass quality and its soundness. Many factors influence the quality of a rock mass including the joint opening and its aperture. In this paper the effect of joint opening in Andesite rock samples were studied using an ultrasonic instrument in laboratory. The rock samples were collected at different depth of boreholes from under construction dam site. Physical and lithological properties of the samples were then determined. Also, artificial joint opening of various apertures (e.g. 0.1, 0.3, 0.5, 1, 2, 3, 5, 10, 20, and 30 mm) were made in the middle part of the samples perpendicular to their longitude axis. The transducers were attached to the both ends of the samples while applying the ultrasonic waves. The results were plotted on graphs which show a correlation between the wave velocity and the joint opening. The plots showed that the wave velocity trends for apertures smaller than 5mm were sharper than those of larger apertures. To evaluate the effect of joint opening on rock mass, velocity reduction ratio (VRR) was introduced. The VRR is defined as a ratio between wave velocity deviations of jointed rock to the wave velocity of intact rock sample ($VRR\% = \frac{V_0 - V_1}{V_0} \times 100$). The VRR of a jointed rock increases with increase in the joint opening.

INTRODUCTION

Detection of fractures in rocks is of the utmost importance because discontinuities such as fractured zones and faults seriously influence the strength of the rock masses (Sassa and Watanabe, 1995).

Ultrasonic measurement is one of the non-destructive geophysical methods commonly used by engineers working in various fields such as mining, geotechniques, civil, and underground engineering as well as oil, gas and minerals explorations (Kahraman, 2007).

Ultrasonic techniques have been used for many years in geotechnical engineering and mining science. They are employed in the field for geophysical investigations and in the laboratory for the determination of